Paleoecology, climate change and forecasting the future of species at risk

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Species at risk (SAR) are vulnerable to ecological changes, even minor ones. Forecast climate change may bring climates unlike any seen for the past several million years. Today the future of species at risk seems much concerned with details of specific sites and poorly understood species-species and species-site interactions. Macro-scale consequences of climate change on SAR receive insufficient attention. Paleoecological studies provide a reliable way to look at the consequences of climate change on SAR at three levels. 1. habitat/ecosystem change, 2. species responses to climatic change, 3. processes of change. Paleoecological studies in British Columbia show that region-wide ecological reorganization will occur, and suggest that managing SAR in situ only is a questionable long-term strategy. However, studies of the coastal temperate rainforest, for example, do identify areas least likely to undergo major habitat changes where in-situ preservation may be viable. Individual species responses can be used as a proxy for ecosystems with rare species and in rare cases to track rare species. The range and dominance of Garry oak (*Quercus garryana*) will likely expand as may the habitat of SAR associated with it. At the species level, blue listed *Ligusticum calderi* is recorded from two Late-glacial sites one where it still occurs and one from which it has disappeared, likely as a result of early Holocene warming and associated forest expansion. Paleoecological studies show that under strong forcing, ecosystem change such as the Younger Dryas event can be rapid and catastrophic allowing little opportunity for migration and dispersal. Major climatic changes are associated with changes in geomorphic processes and these can have profound impacts on adjacent aquatic ecosystems. The occurrence of extreme erosive events in central B.C associated with cooling about 4000 years ago dramatically altered near-shore habitats. Paleoecological studies indicate clearly that because of climate change, SAR management for many species must consider regional landscape and ecosystem change as a top concern.